FURTHER OBSERVATIONS ON THE TROMBIDIID LARVAE OF NEW GUINEA (ACARINA, TROMBIDIIDAE).

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(Fourteen Text-figures.)

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Since the material for previous papers on this subject was prepared, further observations and records have been made. In this paper it is proposed to follow the arrangement of the writer's "Trombidiid Larvae in New Guinea" (1939), thus making the present one supplementary to it.

Names of Species.

It has been necessary to make two alterations in the names of species previously described. By a mischance the name *Neoschöngastia kallipygos* was rendered invalid, and in a recent paper (1939*a*) the name *Neoschöngastia bipygalis* was substituted. Womersley then (1939) erected the genus *Guntheria* to accommodate this species. In another paper (1939*b*) *Trombicula hirsti* variety *buloloensis* was identified with *Trombicula minor* Berlese 1905, the former name becoming a synonym. In addition, Womersley has erected another new genus, *Paraschöngastia*, to accommodate four species described by the writer as belonging to the genus *Neoschöngastia*—*Paraschöngastia yeomansi*, *P. retrocincta*, *P. backhousei*, and *P. dubia*.

General Considerations.

Thanks to the kindness of Dr. F. J. Williams, Chief Medical Officer of Papua, and various members of his staff, I have been able to ascertain that larval mites abound in Papua, but that none have been noted in the dry belt around Port Moresby, while they are uncommon around Misima. Mr. G. W. Lupson of Port Moresby, in a personal communication, states that in the Delta Division "scrub itch" is common, and that it is caused by a larval mite resembling *Trombicula hirsti*. Papuan natives appear to suffer more severely from the attacks of mites than do those of the mandated territory. Their names for them are *tigali*, *sanana* (Motuan), and *dedigalogala* (Luan).

Mr. H. Horne, of the Bulolo Gold Dredging Field Staff, informs me that mites are abundant in the southern part of Dutch New Guinea; and that none are to be found on the Ramu plateau in the mandated territory, which is at an altitude of over 5,500 feet. Recently, in collaboration with Schroeder of Wewak, the writer reported (1939) that the whole of the Sepik District is heavily infested with mites, and that many of the islands off the coast of this district abound with such remarkable numbers that they are called locally "*mokka*-islands".

The finding of colonies of larvae inside the ears of rats, wallabies, bush fowl, and bush turkeys, brings the New Guinea mites in line with those of other countries.

Technique.

Although gum-chloral is infinitely superior to canada balsam for studying detail, it tends to cause specimens to swell so much that after a short time the relationships of certain features are altered, and some of the measurements are increased to an extent which might lead to inaccuracy; it is wise, therefore, to make parallel mounts in balsam, from which to check the gum-chloral preparations.

Hosts.

The following additional records of the occurrence of larvae on known hosts from Bulolo are presented:

1. Bush fowl (*Megapodius duperreyi*): *Trombicula rioi*, *Paraschöngastia retrocincta*, and *P. yeomansi*, all in colonies on the legs; and *Schöngastia blestowei*, in colonies inside the ears.
2. Brown's rat (*Rattus browni*): *Neoschöngastia impar*, in rows along the margins of the ears; *Walchia morobensis*, embedded in the nose; and a new species, *Trombicula vanderghinstei*, in colonies inside the ears.
3. Man: Additional specimens of *Trombicula minor*, making a total of 64 from 9 men; and additional specimens of *Schöngastia blestowei*, making a total of 54 from 8 men. In two instances both species were present on the same host at the same time.

The following new hosts have been recorded from Bulolo:

1. Scrub wallaby (a local highland form of *Macropus* (*Thylogale*) *coxeni* Gray 1866): A colony of 5 specimens of a new species, *Schöngastia taylori*, on the scrotum of one, and many colonies of this species on the legs of another; two new species, *Neoschöngastia womersleyi* and *N. foliata*, in colonies inside the ears of two.
2. Brown scrub rat (a local variant of *Rattus mordax* (*sensu lato*) Thomas 1904): *Guntheria bipygalis* embedded in the skin of the abdomen, and ova cemented to the abdominal hairs; colonies of *Trombicula vanderghinstei* inside the ears, on three examined.

Two species of snipe and one water-rat (*Hydromys oriens* Troughton 1937) were examined without finding any larvae.

In a recent discussion on the epidemiology of endemic typhus in New Guinea (1939c) it was found necessary to classify the hosts of certain larval mites according to the manner in which the various species are found to infest them; there are three categories:

a. The larvae occur in colonies composed of up to fifty, embedded closely together in hollowed-out pits in the skin. These pits are found regularly on certain hosts, and at constant sites.

b. Although no colonies in pits are found, the larvae occur regularly on certain hosts, in relatively large numbers, and at constant sites.

c. Occasional single specimens are found embedded here and there, not in colonies or groups, nor at constant sites, nor regularly on the same host.

I have designated the hosts in categories *a* and *b* as the "principal hosts", and those in category *c* as "casual hosts", and I propose to use these terms in these senses in the future.

Genus Paraschöngastia Womersley 1939.

Trans. Roy. Soc. S. Aust., lxiii, (2), 165.

PARASCHÖNGASTIA YEOMANSI (Gunther 1939). Fig. 1.

Neoschöngastia yeomansi, Gunther, PROC. LINN. SOC. N.S.W., lxiv, 1939, 81.

Coxae iii bear usually two setae, one on the anterior margin towards the medial end, and the other at the extreme antero-lateral angle, instead of only one as originally reported. This will necessitate altering the keys previously published (Gunther, 1939; Womersley, 1939).

Principal host: Bush fowl (*Megapodius duperreyi*), colonies on the legs.

PARASCHÖNGASTIA RETROCINCTA (Gunther 1939). Fig. 2.

Neoschöngastia retrocincta, Gunther, PROC. LINN. SOC. N.S.W., lxiv, 1939, 87.

The tubercles which form the circle surrounding the posterior pole of the body (described previously as "devoid of setae") carry setae in the younger larvae. These setae are from 50 to 57·5μ long, straight, stout, and covered with very short spines; they stand out from the body, pointing slightly backward. They are apparently not very secure, and in older specimens most or all of them may be missing. The chelicerae are slender, with a flattened S-curve; the dorsoapical tooth is a long fine barb pointing backward; the ventral tooth is sharp and prominent, level with the dorsoapical, pointing forward, and forming a continuation of a long ventral ridge. This confirms the provisional placing of this species in the genus *Neoschöngastia* originally. The setae on the cheliceral sheaths (previously described as "apparently nude") are long, slender, straight, and nude.

Principal host: Bush fowl (*Megapodius duperreyi*), colonies on the legs.

Key to the New Guinea species of Paraschöngastia.

1. Coxae iii with 3 setae. No pitted area posteriorly on dorsum. Scutal crest indefinite medially. Dorsal setae 96, arranged: 2, 14, 10, 12, 6, 14, 14, 12, 8, 4 .... *P. dubia* (Gunther 1939)
   Coxae iii with 1 or 2 setae 2
2. Coxae iii with 1 seta. Striations weak over posterior sixth of dorsum, with weak pitting over this area. Dorsal setae 72, arranged: 2, 14, 14, 10, 8, 8, 6, 6, 2, 2 ..... *P. backhousei* (Gunther 1939)
   Coxae iii with 2 setae. Posterior portion of body not striated, but pitted. The setae in this area arising from tubercles 3
3. Pitting over posterior fourth of body. Dorsal setae 100, arranged: 2, 16, 8(10), 12(10), 10(8), 10, 8(10), 12, 6, 6, 6, 4 (the last five rows arising from tubercles) ..... *P. yeomansi* (Gunther 1939)
   Posterior pitted area relatively small, and bounded anteriorly by a circle of tubercles bearing long straight setae (these setae may be missing in older specimens). Dorsal setae 64, arranged: 2, 8(10), 12(10), 6, 8(10), 8, 8(6), circle of tubercles, 12 (arising from irregularly placed oval tubercles) .. *P. retrocincta* Gunther 1939

Genus TROMBICULA Berlese 1905.

Redia, ii, fasc. 2, 155.

TROMBICULA VANDERGHINSTEI, n. sp. Figs. 3, 4, 5.

Body a long oval, widest at level of coxae iii; length, 354μ; width, 223μ; newly-hatched, 206μ × 112μ; largest seen, 370μ × 250μ. Colour pale orange. Striations fine and weak; pitting on scutum, maxilla, and coxae. Maxillary setae stout, with about 7 long fine branches. Chelicerae stout, tapering to a fine sharp point. Dorsoapical tooth single, subterminal, a mere rounded swelling. Ventral tooth opposite the dorsoapical, sharp, pointing backward. A stout seta on each cheliceral sheath, with a few long fine branches. Palpi rounded, but with a slight angulation at the curve of segment ii, and tapering fairly sharply. One long nude seta on ii; a nude seta near the base, and one, branched, near the

apex, on iii; on iv, one nude seta at the base, one (sometimes two) nude seta half-way, and one branched seta towards the apex. Appendiculum short, stout, bluntly rounded, with 6 or 7 setae: one short, stout, and nude, at the base; one very long, with long branches, towards the apex; and 4 or 5, fine, with fine branches, between. Palpal claw trifurcate, the central element very long, curved, with a sharp hooked point; the medial element shorter, very fine and sharp; the lateral element very short, blunt, and so closely applied to the central element as to be visible only in a few specimens. Scutum curved backward, with parallel

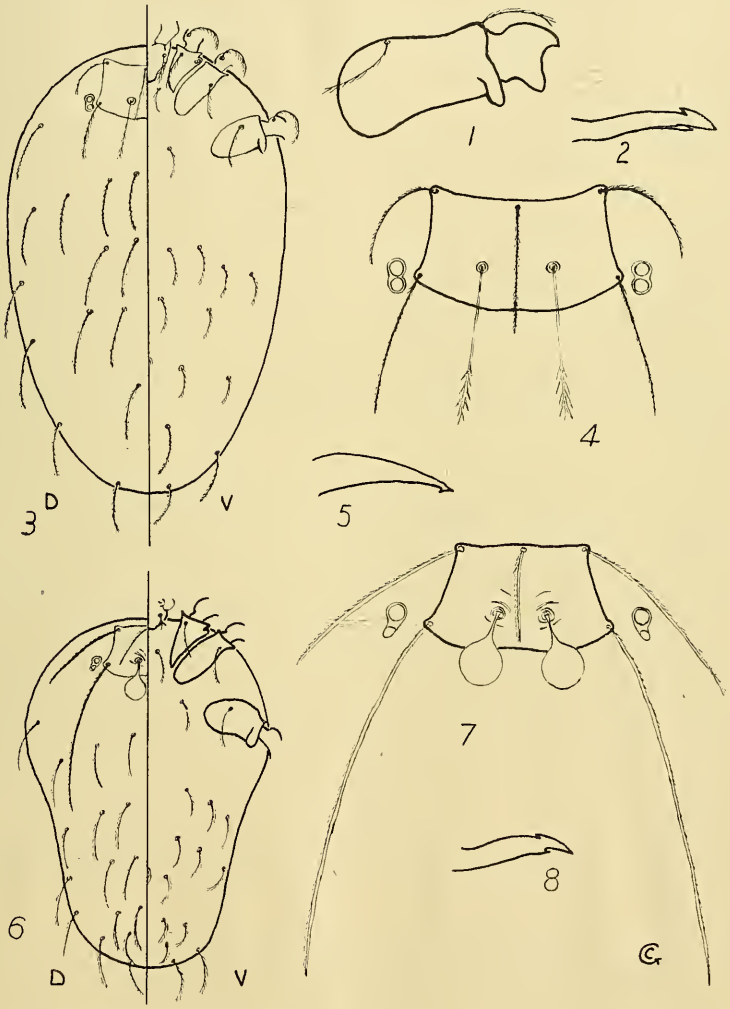


Fig. 1.—Coxa iii of *Paraschöngastia yeomansi.*

Fig. 2.—Chelicera of *P. retrocincta.*

Figs. 3-5.—*Trombicula vanderghinstei*, n. sp. 3, Composite dorsal and ventral diagram; 4, Scutum; 5, Chelicera.

Figs. 6-8.—*Neoschöngastia womersleyi*, n. sp. 7, Scutum; 8, Chelicera.

sides; length, 50μ; width, 84·4μ; set on the forward slope of the body, and only completely visible in newly-hatched specimens. Anterior margin concave; anterior corners angular, projecting slightly; lateral margins very slightly concave; posterior margin convex, the middle third straight or slightly concave; posterior corners angular and projecting slightly. Scutal setae 5: the AM* and PL straight, stout, with short branches on all sides; the AL curved, with short branches on the convex side only. The AM set back from the anterior margin, behind the AL; the AL and PL in the corners. AM, 50μ; AL, 46μ; PL, 56μ. Pseudostigmata two-thirds of the distance back, just in front of the PL setae; 28μ apart. Pseudostigmatic organs filiform, fine, straight, with 7 to 9 long fine branches on the distal two-fifths; length, 63μ. Ocular shield 6μ from the scutum, indented opposite the posterior corners. Eyes double, the anterior the larger and set opposite the pseudostigmata; the posterior just behind the PL setae. Body setae 54: of two forms—those of the dorsum and the last two rows of the venter stout, with short branches on all sides; the remainder of the venter shorter, finer, with relatively longer branches on the convex side only. Dorsum: setae 28, in rows as follows: 2, 8, 6, 6, 4, 2. Row 6 is on the posterior margin of the body. Venter: setae 26, in rows as follows: 2, 2, 8, 4, 4, /4, 2. Row 5 is at the level of the anus. Legs long: i, 209μ; ii, 165μ; iii, 228μ. Leg setae long, slender, slightly curved, with long fine branches on the convex side. Coxal setae single. The seta on each second segment very long and curved. Sixth segments and tarsi of legs i and ii short and wide, those of leg iii very long and slender. A very short stout spur on tarsi i and ii; no spur or nude seta on tarsus iii.

Principal host: The brown scrub rat (a local variant of *Rattus mordax* (*sensu lato*) Thomas 1904), colonies inside the ears. Casual host: Brown's rat (*R. browni* Alston 1877).

Taken at Bulolo, T.N.G., October, 1939. Type specimen in the collections of the School of Public Health and Tropical Medicine, University of Sydney.

This mite belongs to the closely-related group containing *T. minor*, *T. akamushi*, *T. deliensis*, *T. pseudoakamushi* Tanaka 1916, and *T. wichmanni*. Much of the confusion which previously existed in this group has been cleared up, now that Womersley (1939) has proved that *T. hirsti* (and therefore *T. pseudoakamushi* Hatori 1918) is identical with *T. minor*. *T. vanderghinstei* is probably only a local variant of *T. deliensis*, but it is described here as a distinct species until further details about the latter (and the true relationship between *T. deliensis* and *T. akamushi*) can be obtained. They differ in the following respects:

	T. deliensis	*T. vanderghinstei*
Maxillary setae:	nude	branched
Setae on palpal segment iii:	1 nude	1 nude, 1 branched
Scutum:	37μ × 74μ	50μ × 84·4μ

The number and arrangement of the body setae definitely distinguish *T. vanderghinstei* from *T. akamushi*.

Genus Neoschöngastia Ewing 1929.

Manual External Parasites, 187.

Neoschöngastia womersleyi, n. sp. Figs. 6, 7, 8.

Body piriform, widest at level of coxae iii, narrowing sharply just behind them; the posterior pole rounded. Striations moderately strong and fine. Pitting on

* As in previous papers, AL = anterolateral, AM = anteromedian, and PL = posterolateral.

scutum, maxilla, and coxae. Colour pale orange-yellow. Length, 275μ; width, 192μ; largest seen, 320μ × 223μ. Cephalothorax relatively very small. Maxillary setae very short, stout, with two branches. Chelicerae short, stout, slightly curved, tapering to a sharp point. Dorsoapical tooth a fine sharp backward-pointing barb; ventral tooth opposite it, prominent, pointing forward. A long fine nude seta on each cheliceral sheath. Palpi short, rounded, stout at the base, tapering sharply. Details of setae very hard to see. A short seta with several fine branches on ii; a short seta with two branches on iii; on iv, setae approximately as follows: one, stout, with long branches, and one, nude, at the base; two, nude, half-way; one. nude, at the apex; and one with many branches between the previous two. Appendiculum very small, rounded, bearing one short nude seta at the base and four long straight stout setae with long branches along one side. Palpal claw trifurcate, the central element straight, sharp, and tapering roundly; the ventral and dorsal elements shorter, straight, sharply pointed. Scutum twice as wide as long, the anterior margin two-thirds as long as the posterior; length, 39μ; width, 75μ. Anterior margin almost straight; anterior corners angular and projecting slightly; lateral margins concave; posterior margin convex, the middle third concave; posterior corners angular and projecting. Scutal setae 5: the lateral setae long, stout, and slightly curved, bearing a very few fine short branches on the convex side; the AM shorter and finer, with more and larger branches. The AM on the anterior margin; AL in the anterior corners, in line with the AM; PL in the posterior corners. AM, 36μ; AL, 60 to 80μ; PL, 120 to 150μ. Pseudostigmata two-thirds of the way back, just in front of the PL setae; 19μ apart. Crest represented by short oblique lines in front of and behind the pseudostigmata. Pseudostigmatic organs capitate, circular, with no apparent setules; length, 30μ; head, 18·8μ × 16·6μ; stem, 11·2μ. Ocular shield 7·5μ from the scutum. Eyes double, the anterior much the larger, opposite the pseudostigmata; the posterior behind the PL setae. Body setae 56(58), of two forms: those of the dorsum and the last row of the venter short, with short branches on the convex side; the remainder of the venter shorter and finer, with longer branches. Dorsum: setae 28, arranged in rows as follows: 2, 6, 6, 6, 2(4), 4(2), 2. Row 5 has its setae on the lateral margins of the body, in line behind row 1; row 7 is on the posterior margin of the body. Venter: setae 28(30), in rows as follows: 2, 2, 6, 6, 2, 4(6), 2, /4. Row 5 is at the level of the anus; row 8 is on the posterior margin of the body. Legs relatively long; i, 209μ; ii, 167μ; iii, 222μ. Leg setae with short branches on the convex side. Coxal setae single. Sixth segments not markedly expanded or constricted. A short spur on tarsi i and ii; neither spur nor nude seta on iii.

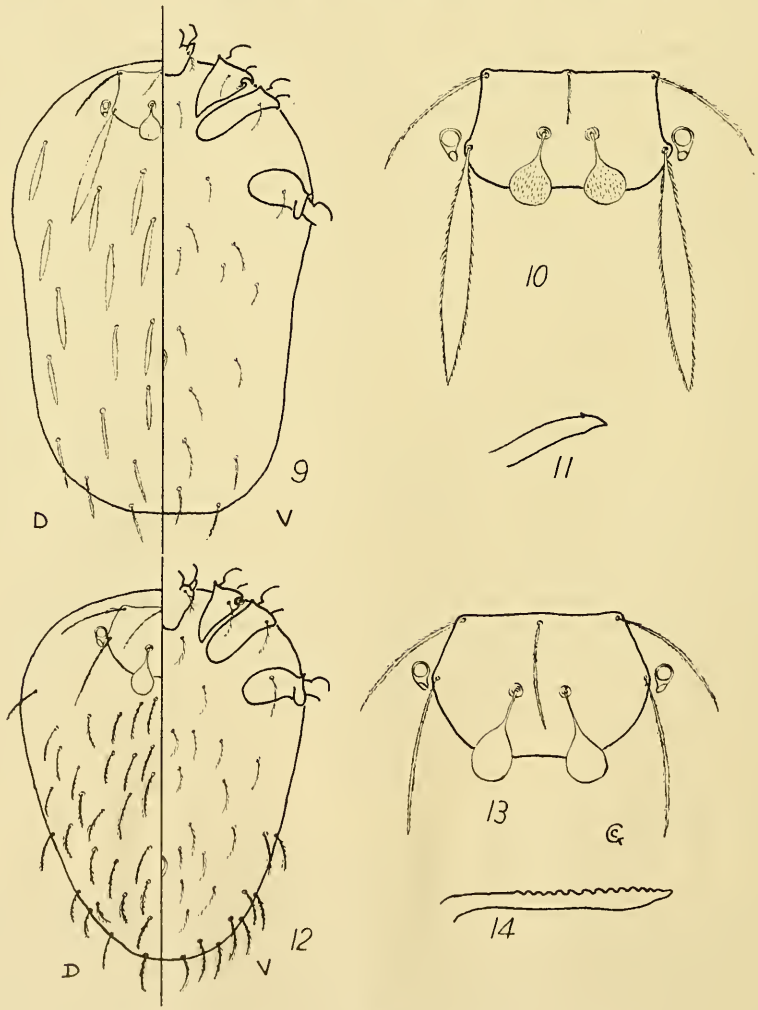
Principal host: Scrub wallaby (a local highland form of *Macropus* (*Thylogale*) *coxeni* Gray 1866), colonies inside the ears. Taken at Bulolo, T.N.G., November, 1939.

Type specimen in the collections of the School of Public Health and Tropical Medicine, University of Sydney.

NEOSCHÖNGASTIA FOLIATA, n. sp. Figs. 9, 10, 11.

Body oval, widest at level of coxae iii, and narrowing very slightly just behind them; the posterior pole bluntly rounded. Striations very fine. Pitting on scutum, maxilla, and coxae. Colour pale orange-yellow. Length, 358μ; width, 240μ; newly-hatched, 187μ × 131μ; largest seen, 389μ × 278μ. Maxillary setae stout, with about six fine branches. Chelicerae slender, slightly curved, tapering bluntly to a sharp point. Dorsoapical tooth a fine sharp barb. Ventral tooth a slight smooth swelling. A long slender nude seta on each cheliceral sheath.

Palpi short and angular. A fine seta with many branches on ii; a shorter seta with a few branches on iii; on iv, one branched seta at the base and two, nude, half-way. Appendiculum very small, bluntly pointed, bearing one short stout nude seta at the base and four branched setae, one very long and stout. Palpal claw trifurcate, the central element the longest, the ventral the shortest. Scutum well forward, almost twice as wide as long; length, 47μ; width, 84μ. Anterior margin straight, projecting around the AM seta; anterior corners rounded, projecting slightly; lateral margins concave; posterior margin convex, curving forward in the lateral fifths to meet the posterior corners; posterior corners rounded. Scutal setae 5: the AM very short and fine, with fine branches all over; the AL longer and stouter, with branches on all sides; the PL broad and



Figs. 9-11.—*Neoschöngastia foliata*, n. sp. 10, Scutum; 11, Chelicera.
Figs. 12-14.—*Schöngastia taylori*, n. sp. 13, Scutum; 14, Chelicera.

flat, very long, conforming to the type of the dorsal body setae. The AM in the projection of the anterior margin, in line with the AL; the lateral setae in the corners. Their lengths vary, sometimes even on the same specimen: AM, 19 to 25μ; AL, 50 to 56μ; PL, 87 to 100μ. Pseudostigmata just more than half-way back, in front of the PL setae; 19μ apart. No obvious crest. Pseudostigmatic organs capitate, the head circular and covered with fine short setules; length, 28μ; head, 15μ × 16μ; stem, 13μ. Ocular shield very close to the scutum. Eyes double, the anterior the larger, opposite the pseudostigmata; the posterior behind the PL setae. Body setae 60: those of the dorsum flat, narrow at the base, 6·5μ wide at the middle, 50 to 62·5μ long, tapering to a sharp point, with two rows of short setae down each edge. Those of the venter very short and fine, slightly curved, with short fine branches on the convex side; towards the posterior pole they are longer and thicker. Dorsum: setae 32, arranged in rows as follows: 2, 6, 6, 6, 6, 4, 2. Row 7 is on the posterior margin of the body. Venter: setae 28, arranged in rows as follows: 2, 2, 4, 6, 4, 2, 4, 4. The anus is between rows 5 and 6; row 8 is on the posterior margin of the body. Legs short: i, 182μ; ii, 155μ; iii, 215μ. Leg setae fine, short, slightly curved, with short branches on the convex side. Coxal setae single. A short stout spur on tarsi i and ii.

Principal host: Scrub wallaby (a local highland form of *Macropus* (*Thylogale*) *coxeni* Gray 1866), colonies inside the ears. Taken at Bulolo, T.N.G., November, 1939.

Type specimen in the collections of the School of Public Health and Tropical Medicine, University of Sydney.

Genus Schöngastia Oudemans 1910.

Ent. Bericht., iii, No. 54, 86.

Schöngastia taylori, n. sp. Figs. 12, 13, 14.

Body oval, widest between coxae ii and iii, posterior pole narrow. Striations fine and strong. Pitting on scutum, maxilla, and coxae. Colour bright orange. Length 292μ; width, 223μ; newly-hatched, 209μ × 125μ. Maxillary setae short, with about 7 branches. Chelicerae long and slender, armed with 14 denticles along the distal four-fifths. Cheliceral sheaths as long as the chelicerae, each bearing a long slender nude seta. Palpi rounded; a short branched seta on ii and iii; on iv, one seta with about four branches near the base, and one, nude, near the apex. Appendiculum rounded, bearing two nude and four branched setae. Palpal claw bifurcate, the medial element long, stout, and hooked, the lateral straight, shorter, and finer. Scutum rounded, roughly hexagonal, half as wide again as long; length, 57μ; width, 87μ. Anterior margin straight; anterior corners rounded; lateral margins straight; posterior margin convex, the middle third straight, the lateral thirds sloping forward to meet the posterior corners; posterior corners rounded. Scutal setae 5: stout, with many fine branches on all sides. AM back from the anterior margin, behind the AL setae; the lateral setae in the corners. Lengths varying: AM, 42μ; AL, 56μ; PL, 63μ. Pseudostigmata two-thirds of the way back, behind the PL setae; 19μ apart. Pseudostigmatic organs capitate, racquet-shaped, bearing no setules; length, 37·5μ; head, 23μ × 15μ; stem, 14μ. Ocular shield close to scutum. Eyes double, the anterior the larger, its posterior margin opposite the PL setae; the posterior opposite the pseudostigmata. Body setae 108; those of the dorsum stout, with short branches all over; those of the venter finer, with branches on the convex side only. Towards the posterior pole the dorsal rows continue around the sides of the body, the end setae encroaching

on the venter. Dorsum: setae 78, arranged in rows as follows: 2, 10, 2, 12, 2, 14, 2, 10, 12, 8, 4. Rows 3, 5 and 7 are on the lateral margin of the body, in line behind row 1; in some specimens these setae appear to be a continuation of the row next in front. Rows 6, 8, 9 and 10 each pass onto the venter. The setae of row 11 form a square on the end of the body. Venter: setae 30, arranged in rows as follows: 2, 2, 8, 4, 4, 4, 4, 2. The anus is between rows 6 and 7; rows 5, 7, and 8 are opposite the ends of dorsal rows, 6, 8, and 9 respectively. Legs long: i, 223μ; ii, 167μ; iii, 220μ. Leg setae fine, slightly curved, with branches on the convex side. Coxal setae single. Sixth segment of leg iii moderately constricted at the base, moderately expanded distally. Tarsi i and ii short and tapered; iii slender. A short stout spur on i; that on ii shorter and finer; a long slender nude seta on iii.

Principal host: Scrub wallaby (a local highland form of *Macropus* (*Thylogale*) *coxeni* Gray 1866), colonies on scrotum and hind legs. Taken at Bulolo, T.N.G., November, 1939.

Type specimen in the collections of the School of Public Health and Tropical Medicine, University of Sydney.

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